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(54) Disposable Diaper

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(72) Inventor Isao HIRANO

c/o Sakata Shokai Co., Ltd. Chuo Building, 2-6-2 Minamimori-machi, Higashi Tenma,  
Kita-ku, Osaka-shi

(71) Applicant Sakata Shokai Co., Ltd.

Chuo Building, 2-6-2 Minamimori-machi Higashi Tenma, Kita-ku, Osaka-shi

## SPECIFICATION

### 1. TITLE OF THE INVENTION DISPOSABLE DIAPER

### 2. SCOPE OF THE UTILITY MODEL CLAIMS

#### [Claim 1]

A disposable diaper having an absorbent member enclosed between a moisture impermeable outer layer and a moisture permeable inner layer, comprising a moisture detecting part wherein a water insoluble coloring agent layer is formed on the inner surface of the moisture impermeable outer layer, and a water soluble coloring agent

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layer is laminated over the aforementioned coloring agent layer.

[Claim 2]

The disposable diaper according to utility model claim 1, wherein the water soluble coloring agent layer is formed from a water based coloring agent in which a dye and/or pigment is dissolved and/or dispersed in a water based binder.

[Claim 3]

The disposable diaper according to utility model claim 1, wherein the water insoluble coloring agent layer is formed from an oil based coloring agent where a dye and/or pigment is dissolved and/or dispersed in an oil based binder.

[Claim 4]

The disposable diaper according to utility model claim 1, wherein the color of the water insoluble coloring agent layer and the color of the water soluble coloring agent layer are the same color or approximately the same color.

### 3. DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a disposable diaper with a moisture detecting part, and in particular, relates to a disposable diaper wherein the color changes in a pattern or text such as a printing pattern provided on the diaper beforehand, and thereby the wetness of the diaper can easily be detected.

Conventionally, checking a diaper for wetness and soiling has been extremely inconvenient for caregivers of infants and the elderly who wear diapers, and being able to detect these conditions from outside the diaper easily is desired. Many proposals have previously been made to satisfy this desire, such as a method where the diaper will electrically generate light or sound due to wetness, a method where the diaper generates a fragrance, and a method where color is generated or changed by a special indicator chemical due to the effect of water or urine or the like. However, the aforementioned methods fail to take into consideration the psychological aspects of infants and the elderly, or are lacking with regard to safety, hygiene, or detection certainty, and the like.

Furthermore, there have also been proposals that relate to a type of indicator chemical in which a coloring agent is washed off and becomes non-visible by contact with moisture, but in this case, the detection certainty is lacking because the coloring agent, which is the indicator chemical, disappears.

As a result of diligent research to resolve the aforementioned problems with

conventional detection methods, the present inventors have achieved the present invention by discovering inexpensive means for simple and certain detection that can be applied to disposable diapers, and particularly to those that have recently become widely used.

A representative example of a disposable diaper that has been widely used in the past is the diaper with the construction shown in FIG. 1 and FIG. 2.

The disposable diaper shown in FIG. 1 and FIG. 2 has a moisture impermeable outer layer 12 and a moisture permeable inner layer 11 with an absorbent member 14 enclosed therein. Furthermore, if using on an infant or the like, the diaper is used by fastening it to the body using adhesive tape 13 or the like.

Furthermore, the moisture impermeable outer layer 12 is made from a soft semi-transparent polyethylene film or the like, and the moisture permeable inner layer 11 is made from a thin sheet material such as a soft nonwoven material.

Furthermore, the absorbent member 14 enclosed in the aforementioned two layers is primarily made of a moisture absorbent fibrous material such as crushed pulp, and if necessary can also contain special materials such as water absorbent polymer materials and the like. Note, the absorbent member 14 is enclosed in normal thin paper or a web sheet 15 or the like.

The present invention provides a disposable diaper having an absorbent member enclosed between a moisture impermeable outer layer and a moisture permeable inner layer as shown in FIG. 1 and FIG. 2, containing a moisture detecting part wherein a water insoluble coloring agent layer is formed on the inner surface of the moisture impermeable outer layer, and a water soluble coloring agent layer is laminated over the aforementioned water insoluble coloring agent layer.

FIG. 3 shows a specific example of a disposable diaper with a moisture detecting part, wherein (a) is a partial cross-section view and (b) is a drawing showing a part of the inner surface of the moisture impermeable outer layer.

The present invention has a moisture detecting part 2, which is a laminate body made by first forming a water insoluble coloring agent layer 21 with water resistance on the inner surface of the moisture impermeable outer layer 12, and then providing a water soluble coloring agent layer 22 with properties that allow the coloring agent to be washed off by wetting it with water, formed by lamination on the water insoluble coloring agent layer. By being laminated with materials with different water resistances, if the laminate body becomes wet with water, the pattern such as an image or text formed by the water soluble coloring agent layer will wash off, but the water insoluble coloring agent layer with water resistance will not wash off and will remain.

By using these properties, an image or text or the like will appear or will change appearance such that the wetness can be detected.

Herein, the water insoluble coloring agent layer and the water soluble coloring agent layer can be formed by normal application means such as flexographic printing, gravure printing, and screen printing, or multiple layers can be formed using a roll coater or spray method or the like. The water soluble coloring agent layer is formed by applying a water based coloring agent primarily containing a water based binder with a coloring agent in the binder.

Furthermore, the water insoluble coloring agent layer is formed by applying an oil based coloring agent that contains a coloring agent in an oil soluble or solvent based binder.

Note, the water based binder can be a water soluble binder made from a resin such as an acrylic resin, a styrene-acrylic resin, an ethylene-acrylic resin, a styrene-maleic acid resin, a maleic acid resin, a rosin-maleic acid resin, polyvinyl alcohol, polyvinyl acetal, casein, zein, carboxymethyl cellulose, and shellac and the like. These resins can be used individually or 2 or more types can be blended together, depending on the objective of use. Furthermore, an aqueous dispersion of a water-based binder resin such as an acrylic resin, styrene-acrylic resin, styrene-shellac resin, vinyl acetate resin, vinyl chloride-vinyl acetate resin, or polyester resin can also be used.

Furthermore, the coloring agent that is used in the water soluble coloring agent can be a water soluble dye or pigment (including white pigments) and the like. Note, the alkali that is used to make the water soluble binder water soluble is preferably an alkali that has low volatility such as sodium hydroxide, triethanolamine and the like.

On the other hand, the water insoluble oil based binder can be a binder such as cellulose nitrate, polyamide, rubber chloride, ethylene-vinyl acetate copolymer, polypropylene chloride, acrylic, urethane, shellac, and rosin, and the like that are used in oil based paints or printing inks, dissolved in various types of organic solvents. Furthermore, the coloring agent that is used in the water insoluble oil based coloring agent can be an oil soluble dye or pigment (including white pigments).

Note, the color of the water based coloring agent layer and color of the oil based coloring agent layer can be different color hues, but from the perspective of the certainty of detection before and after wetness, it is more effective to laminate with coloring agents of the same color or with color hues of the approximately the same color so that the pattern such as an image or text or the like formed by the oil based coloring agent cannot easily be detected before becoming wet.

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The present invention is described below in greater detail using concrete examples, but the present invention is not restricted to these examples.

#### Water Based Coloring agent Manufacturing Example 1

A 5% aqueous solution of polyvinyl alcohol (Gosenol GH-13, manufactured by Nippon Synthetic Chemical Industry Co., Ltd.) was prepared, and then 1 weight% of food coloring red #3 (manufactured by Kiriya Chemical Co., Ltd.) and 9 weight% of ethanol were added to 90 weight% of the aqueous solution to produce water based coloring agent 1.

#### Water Based Coloring agent Manufacturing Example 2

Water based coloring agent 2 was manufactured by adding 1 weight% of food coloring blue #1, 40 weight% of ethanol, and 19 weight% of water to 40 weight% of a 25% nonvolatile fraction aqueous solution of acrylic resin (Joncryl-142, manufactured by Johnson Corporation) that was neutralized with sodium hydroxide.

#### Oil Based Coloring agent Manufacturing Example 1

Oil based coloring agent 1 was manufactured by adding 15 weight% of cellulose nitrate (manufactured by Asahi Kasei Corp.) and 10 weight% of polyamide resin (Polymide S40EA, manufactured by Sanyo Chemical Co. Ltd.) in 74.5 weight% of a solvent blend containing toluene, isopropanol, and ethyl acetate, and then adding and dissolving 0.5 weight% of ozarole [spelling unknown] pink dye.

#### Oil Based Coloring agent Manufacturing Example 2

Oil-based coloring agent 2 was manufactured by dissolving 15 weight% of the nonvolatile fraction urethane resin (Sanprene, manufactured by Sanyo Chemical Co. Ltd.) and 5 weight% of cellulose nitrate (manufactured by Asahi Kasei Corp.) in 79 weight% of a solvent blend containing toluene, isopropanol, and methyl ethyl ketone, and then adding 1 weight% of cyanine blue pigment and kneading with a paint shaker.

#### Embodiments 1 through 4

Disposable diapers with a moisture detecting part were manufactured by laminating and applying the water-based coloring agents 1 and 2 and oil-based coloring agents 1 and 2 by gravure printing in the combinations shown in the following table onto the inner layer of the white polyethylene film that is used as the water insoluble outer layer of the disposable diaper in order to form the moisture detecting part.

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Approximately 100 mL of water was added from the moisture permeable inner layer side of the disposable diaper with a wetness detecting part, the printing pattern of the laminated water-soluble coloring agent layer was washed off, and then the condition of only the remaining water insoluble coloring agent layer on the bottom was observed. Then, the rate of change from the pattern of the water soluble coloring agent layer to the pattern of the water in soluble coloring agent layer was evaluated. If the change was completed within 5 minutes, an evaluation of O was made

	Embodiment			
	1	2	3	4
Coloring Agent Name	1		2	
Coating Agent Name	1	2	1	2
Change in Printing Pattern	O	O	O	O

From the foregoing results, it can be seen that the moisture detecting part of the present invention was a detecting part that was sensitive to wetness, and moisture detection was more certain because both coloring agents were of the same color or the colors were approximately the same.

FIG. 4 is a drawing showing an example that is convenient for detection by forming the coloring agent layer and the coating layer with various images and text. FIG. 4 shows an example where the text "WET" is formed by the water insoluble coloring agent layer and the water-soluble coloring agent layer is overlaid in the form of the stripe in order to hide the "WET" text. Prior to wetting, a stripe pattern (A) is shown, but after wetting, the text "WET" (B) appears.

Note, the moisture detecting part can be formed on the entire surface or locally on any part of the inner surface of the water impermeable outer layer of the disposable diaper.

#### 4. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 and FIG. 2 are drawings showing the construction of a representative disposable diaper, and FIG. 1 is a perspective view of the appearance, while FIG. 2 is a cross-section view showing the internal construction.

FIG. 3 shows a concrete example of the construction of a disposable diaper according to the present embodiment, where (a) is a partial cross section view, and (b) is

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a drawing showing a part of the inner surface on the moisture impermeable outer layer.

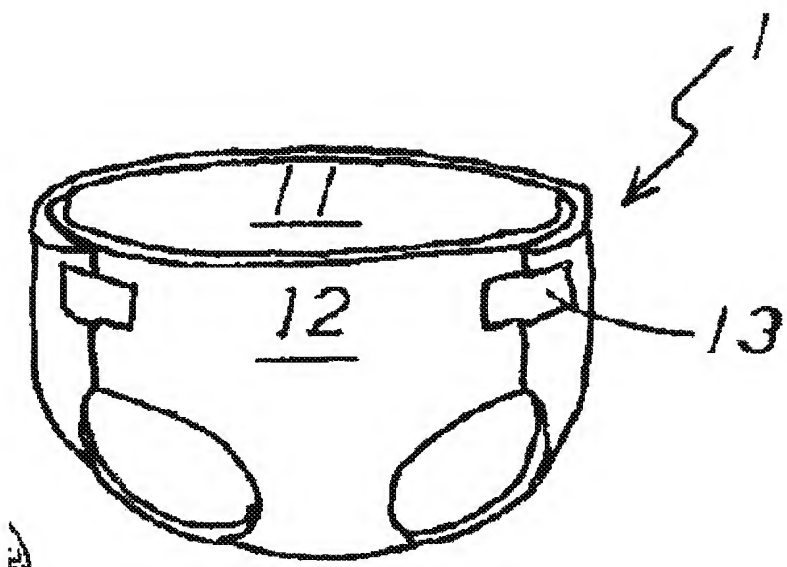
FIG. 4 is a drawing showing an example that makes detection convenient by forming the water impermeable coloring agent layer and the water permeable coloring agent layer with images and text.

Applicant    Sakata Shokai Co., Ltd.

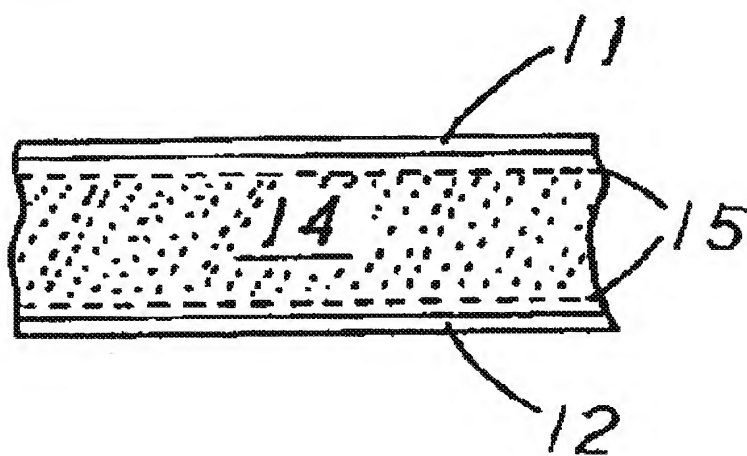
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[FIG. 1]

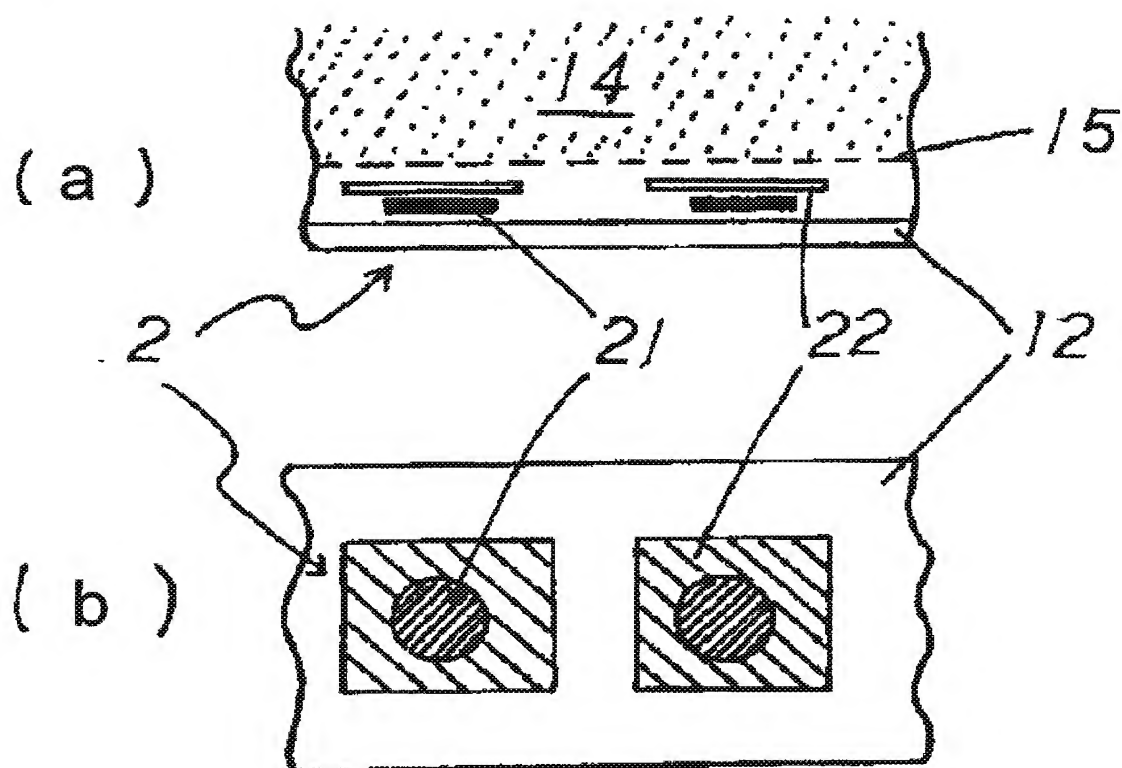


[FIG. 2]





[FIG. 3]



[FIG. 4]

